Reproduced with the permission of Pergamon Press Inc., by University Microfilms Inc. Duplication or resale without permission is prohibited.

CONTENTS OF VOLUME 51

January **Number 1**

CEDAR SCIENCE—PART II

A. H. MANSON and A. O'NEILL: Foreword 1

F. VIAL: Tides in the middle atmosphere 3

D. K. CHAKRABARTY, G. BEIG, J. S. SIDHU and S. R. DAS: Fine scale structure and turbulence parameters in the equatorial middle atmosphere 19

M. E. MCINTYRE: On the Antarctic ozone hole 29

K. C. YEH and B. DONG: The non-linear interaction of a gravity wave with the vortical modes 45

G. J. BYRNE, J. R. BENBROOK, E. A. BERING, B. LIAO and J. R. THEALL: Summertime stratospheric wind measurements above the South Pole 51

International Geophysical Calendar 1989 I

February **Number 2**

J. M. LADWIG and A. R. W. HUGHES: An asymmetry in the direction of arrival of whistlers at Sanae, Antarctica 61

J. K. WALKER: Spherical cap harmonic modelling of high latitude magnetic activity and equivalent sources with sparse observations 67

S. LAL, R. BORCHERS, P. FABIAN and B. C. KRUEGER: The vertical distribution of CH_4, N_2O, CFC-12 and CFC-11 in the middle atmosphere at mid-latitudes 81

P. GREET and F. JACKA: Observations of the sodium layer using a Fabry–Perot spectrometer: twilight temperature variations 91

M. KÄHLER: The effects of non-linearity on thermal tides in a 3-D numerical model 101

L. TŘÍSKOVÁ: The vernal–autumnal asymmetry in the seasonal variation of geomagnetic activity 111

A. PHILLIPS: Simultaneous observations of the quasi 2-day wave at Mawson, Antarctica, and Adelaide, South Australia 119

A. ETEMADI, S. W. H. COWLEY and M. LOCKWOOD: The effect of rapid changes in ionospheric flow on velocity vectors deduced from radar beam-swinging experiments 125

R. G. RASTOGI and A. PATIL: Equatorial counter-electrojet and the $F2$-layer of the ionosphere 139

Short papers

B. R. CLEMESHA and D. M. SIMONICH: Comments on a paper entitled "Sudden neutral sodium layers: a strong link to sporadic *E* layers" by U. von Zahn and T. L. Hansen 145

U. VON ZAHN and T. L. HANSEN: Reply to comments by B. R. Clemesha and D. M. Simonich on a paper entitled "Sudden neutral sodium layers: a strong link to sporadic *E* layers" 147

Book review 151

March **Number 3**

K. G. BUDDEN: Obituary—Henry George Booker (1910–1988) 153

N. B. TRIVEDI, R. P. KANE, A. L. PADILHA and J. M. DA COSTA: Geomagnetic daily variations in H at Alcântara and Eusébio in the Brazilian equatorial region 155

E. B. WODNICKA and L. NATORF: Further experiments with maximum entropy power spectra of sinusoids 159

C. A. ONWUMECHILI and P. C. OZOEMENA: Contours of equatorial electrojet current density 163

R. SRIDHARAN, R. RAGHAVARAO, R. SUHASINI, R. NARAYANAN, R. SEKAR, V. V. BABU and V. SUDHAKAR: Winds, wind-shears and plasma densities during the initial phase of a magnetic storm from equatorial latitudes 169

B. S. LANCHESTER, H. RISHBETH, T. NYGRÉN, L. JALONEN and T. TURUNEN: Wave activity, *F*1-layer disturbance and a sporadic *E*-layer over EISCAT 179

J. LABELLE: Radio noise of auroral origin: 1968–1988 197

K. OLAFSSON and S. ULLALAND: On the relationship between cosmic noise absorption and auroral X-rays—a case study 213

W. R. FROM, J. MACGIBBON and J. D. WHITEHEAD: A strange result in the measurement of the angles of arrival of the first and second echoes from the ionosphere at high radio frequencies 223

D. LLANWYN JONES and G. S. JOYCE: The computation of ELF radio wave fields in the Earth–ionosphere duct 233

April **Number 4**

L. KERSLEY, C. D. RUSSELL and S. E. PRYSE: Scintillation and EISCAT investigations of gradient-drift irregularities in the high latitude ionosphere 241

GY. TARCSAI, H. J. STRANGEWAYS and M. J. RYCROFT: Error sources and travel time residuals in plasmaspheric whistler interpretation 249

S. KIRKWOOD and P. N. COLLIS: Gravity wave generation of simultaneous auroral sporadic-*E* layers and sudden neutral sodium layers 259

LAKHA SINGH, TUHI RAM TYAGI, Y. V. SOMAYAJULU, P. N. VIJAYAKUMAR, R. S. DABAS, B. LOGANADHAM, S. RAMAKRISHNA, P. V. S. RAMA RAO, A. DASGUPTA, G. NAVNEETH, J. A. KLOBUCHAR and G. K. HARTMANN: A multi-station satellite radio beacon study of ionospheric variations during total solar eclipses 271

P. L. DYSON and D. L. ROBERTS: Characteristics of ionospheric irregularities capable of producing quasi-horizontal traces on ionograms 279

B. A. ENDERSBEE, F. T. FARMER and J. O'SHANNASSY: Pulse transit times and waveform observations for ionospheric propagation between England and Australia 291

A. R. JACOBSON and R. C. CARLOS: Coherent-array HF Doppler sounding of traveling ionospheric disturbances: I. Basic technique 297

W. MEYER, R. SIEBENMORGEN and H.-U. WIDDEL: Estimates of gravity wave momentum fluxes in the winter and summer high mesosphere over northern Scandinavia 311

H. RISHBETH and R. EDWARDS: The isobaric *F*2-layer 321

N. R. THOMSON: Re-radiation of VLF radio waves from mountain ranges 339

May **Number 5**

O. PINTO JR and W. D. GONZALEZ: Energetic electron precipitation at the South Atlantic Magnetic Anomaly: a review 351

C. VAROTSOS: Comment on connections between the 11-year solar cycle, the Q.B.O. and total ozone 367

S. ALEX, P. V. KOPARKAR and R. G. RASTOGI: Spread-*F* and ionization anomaly belt 371

D. PANCHEVA, E. APOSTOLOV, J. LAŠTOVIČKA and J. BOŠKA: Long-period fluctuations of meteorological origin observed in the lower ionosphere..... 381

L. NATORF, A. W. WERNIK, E. B. WODNICKA and K. SCHLEGEL: Detecting travelling ionospheric disturbances in incoherent scatter data using the Maximum Entropy Method 389

J. D. WHITEHEAD: Recent work on mid-latitude and equatorial sporadic-*E*..... 401

S. M. NEWBERY, P. L. DYSON and A. SINGH: An inversion procedure for obtaining collision frequency profiles from swept-frequency absorption measurements..... 425

Y. SAHAI, J. A. BITTENCOURT, N. R. TEIXEIRA and H. TAKAHASHI: Seasonal variations of tropical *F*-region nightglow emissions and correlative ionospheric studies 433

M. J. BUONSANTO: Comparison of incoherent scatter observations of electron density, and electron and ion temperature at Millstone Hill with the International Reference Ionosphere 441

June **Number 6**

PUBLISHER'S ANNOUNCEMENT: Change of Editor-in-Chief i

K. L. JONES: Mechanisms for vertical separation of ions in sporadic-*E* layers 469

M. Roy and R. G. Rastogi: A semi-analytic method for studying plasma properties near the *F*2-peak of the low latitude ionosphere 477

K. Suvanto, M. Lockwood, K. J. Winser, A. D. Farmer and B. J. I. Bromage: Analysis of incoherent scatter radar data from non-thermal *F*-region plasma 483

Yong-Fu Wu and Hans-Ulrich Widdel: Turbulent energy dissipation rates and eddy diffusion coefficients derived from foil cloud measurements 497

D. D. Sentman: Detection of elliptical polarization and mode splitting in discrete Schumann resonance excitations 507

E. Knudsen, S. Israelsson and B. Hallberg: Measurements of the electrode effect over flat, snow-covered ground 521

E. Knudsen, K. P. S. C. Jayaratne and S. Israelsson: An investigation of sources of errors by space charge measurements using the Obolensky filter method 529

S. Sampath, S. Murali Das and V. Sasi Kumar: Electrical conductivites, ion densities and mobilities in the middle atmosphere over India –balloon measurements..... 533

M. A. Miah: Observation of low energy particle precipitation at low altitude in the equatorial zone 541

July/August **Number 7/8**

ATMOSPHERIC TIDES

W. J. Granville Beynon: Editorial note 551

J. M. Forbes: Foreword..... 553

G. J. Fraser, R. A. Vincent, A. H. Manson, C. E. Meek and R. R. Clark: Inter-annual variability of tides in the mesosphere and lower thermosphere 555

P. J. S. Williams and T. S. Virdi: EISCAT observations of tidal modes in the lower thermosphere 569

A. H. Manson, C. E. Meek, H. Teitelbaum, F. Vial, R. Schminder, D. Kürschner, M. J. Smith, G. J. Fraser and R. R. Clark: Climatologies of semi-diurnal and diurnal tides in the middle atmosphere (70–110 km) at middle latitudes (40–55°) 579

S. K. Avery, R. A. Vincent, A. Phillips, A. H. Manson and G. J. Fraser: High-latitude tidal behavior in the mesosphere and lower thermosphere 595

R. A. Vincent, T. Tsuda and S. Kato: Asymmetries in mesospheric tidal structure 609

R. R. Clark: The quasi 2-day wave at Durham (43°N): solar and magnetic effects 617

R. Schminder, D. Kürschner, A. H. Manson and C. E. Meek: Semidiurnal tidal winds at Collm (52°N, 15°E) and Saskatoon (52°N, 107°W) over the decade 1978–1988 623

H. Teitelbaum, F. Vial, A. H. Manson, R. Giraldez and M. Massebeuf: Non-linear interaction between the diurnal and semidiurnal tides: terdiurnal and diurnal secondary waves..... 627

S. Miyahara and Deng-Hua Wu: Effects of solar tides on the zonal mean circulation in the lower thermosphere: solstice condition 635

J. M. Forbes and F. Vial: Monthly simulations of the solar semidiurnal tide in the mesosphere and lower thermosphere 649

F. Vial and J. M. Forbes: Recent progress in tidal modelling 663

Susumu Kato: Non-migrating tides 673

E. S. Kazimirovsky and E. I. Zhovty: Midlatitude seasonal behaviour of tides near the mesopause level 683

September/October **Number 9/10**

HENRY G. BOOKER MEMORIAL ISSUE

G. Beynon and K. Budden: Foreword 689

K. G. Budden: Some extensions of the Booker method of ray tracing 691

J. Heading: The structure of the QL and QT approximations to the plasma refractive index 699

K. Suchy and C. Altman: Relations between eigenmode scattering matrices in curved-stratified cold magnetoplasmas 707

D. Y. Zhang and K. D. Cole: Voltage and current sources of high latitude thermospheric movements 715

J. A. Fejer, F. T. Djuth, H. M. Ierkic and M. P. Sulzer: Simultaneous observations of the enhanced plasma line and of the reflected HF wave at Arecibo 721

S. P. Kuo and M. C. Lee: Parametric excitation of whistler waves by HF heater 727

J. A. Klobuchar and M. C. Lee: Periodic amplitude variations as precursors of plumes of equatorial ionospheric irregularities 733

H. O. Vats: Survey of diffractive-refractive scintillation theory 739

A. Hewish: A user's guide to scintillation 743

C. P. Liao, J. P. Freidberg and M. C. Lee: Explosive spread F caused by lightning-induced electromagnetic effects 751

I. G. Platt and P. L. Dyson: MF and HF propagation characteristics of ionospheric ducts 759

I. G. Platt and P. L. Dyson: MF and HF ducting within equatorial bubbles 775

K. Rawer and D. Bilitza: Electron density profile description in the international reference ionosphere 781

R. N. Bracewell: Physical aspects of the Hartley transform 791

R. M. Bevensee: Compensation-theorem analyses of ground wave propagation over irregular, inhomogeneous terrains 797

KAI-FONG LEE: Microstrip patch antennas—basic properties and some recent advances 811

HSI-TIEN CHANG: Borehole directional radar system for geological mapping..... 819

A. L. CULLEN: Henry Booker and the impedance concept 829

B. NICHOLS: Radio propagation studies at Cornell in the forties and fifties..... 831

F. W. G. WHITE: A visit to New Guinea—1944 837

W. E. GORDON: Henry George Booker..... 839

November/December **Number 11/12**

B.-H. AHN, Y. KAMIDE, S.-I. AKASOFU, H. W. KROEHL and D. J. GORNEY: Ionospheric conductivity dependence of the cross-polar cap potential difference and global Joule heating rate 841

A. S. RODGER, G. L. WRENN and H. RISHBETH: Geomagnetic storms in the Antarctic *F*-region. II. Physical interpretation..... 851

V. P. BHATNAGAR and G. G. SHEPHERD: The seasonal variations in the nighttime 6300 Å emission at midlatitudes from ISIS-II spacecraft..... 867

F. T. BERKEY and G. H. STONEHOCKER: A comparison of the height of the maximum electron density of the *F*2-layer from real height analysis and estimates based on M(3000)F2 873

A. R. JACOBSON and R. C. CARLOS: Coherent-array HF Doppler sounding of traveling ionospheric disturbances: II. Assessment of errors 879

I. G. PLATT and P. L. DYSON: VHF propagation modes within ionospheric waveguides 897

I. G. PLATT and P. L. DYSON: VHF transequatorial propagation via three dimensional waveguides 911

M. V. USPENSKY, G. V. STARKOV, G. S. STEPANOV and P. J. S. WILLIAMS: The amplitude of auroral backscatter: II. Topology of the backscatter range-azimuth distribution 929

P. POLLARI, A. HUUSKONEN, E. TURUNEN and T. TURUNEN: Range ambiguity effects in a phase coded *D*-region incoherent scatter radar experiment 937

A. SINGH and K. D. COLE: Ion–neutral collisions and the equatorial electrojet 947

G. O. WALKER and H. F. CHAN: Computer simulations of the seasonal variations of the ionospheric equatorial anomaly in East Asia under solar minimum conditions..... 953

J. L. STANFORD and R. C. SAKSENA: Oscillations in *D*-region absorption at periods of one to two months 975

D. K. CHAKRABARTY and S. GANGULY: On significant quantities of negative ions observed around the mesopause..... 983

YONG-FU WU and H.-U. WIDDEL: Observational evidence of a saturated gravity wave spectrum in the mesosphere 991

R. L. Collins and P. K. Rastogi: Fractal analysis of gravity wave spectra in the middle atmosphere 997

A. H. Manson and C. E. Meek: Heights of MF radar scatter (1986/87) and the wind field (55–95 km): Saskatoon, Canada 1003

Deng-Hua Wu, S. Miyahara and Y. Miyoshi: A nonlinear simulation of the thermal diurnal tide 1017

S. Dhanorkar, C. G. Deshpande and A. K. Kamra: Atmospheric electricity measurements at Pune during the solar eclipse of 18 March 1988 1031

D. Yeboah-Amankwah: Fair weather electric field in Port Moresby 1035

International Geophysical Calendar 1990 I

Volume Contents and Author Index i